EVALUATION OF SHOULDER STABILITY IN YOUNG AND ELDERLY SUBJECTS WITH HELICAL AXIS TECHNIQUE

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Background and Aim

The shoulder complex composed by glenohumeral, scapulothoracic, acromioclavicular and sternoclavicular joints, permits the arm and hand orientation and it has the highest degree of mobility in the human body. The location of the instantaneous axis of rotation of a joint can be estimated through the analysis of the Helical Axes (HA). The dispersion and orientation of HA can be used as an index of joint stability, and it has been applied to ankle, knee and cervical spine and their behaviour seems to depend on the features of joint surfaces.1,2

Several studies reported age-related changes in shoulder complex morphology due to the physiological joint surfaces degeneration in asymptomatic subjects, mainly due to the irregularities arising for the articular cartilage consumption. Therefore, the aim of this study was to observe differences in the HA dispersion in different age groups during different upper limbs movements.

Materials and Methods

Forty volunteers were enrolled in the study: 20 young (age 20-30 years) and 20 elderly (age over 65 years). Subjects were asked to perform four different movements with both arms, while being seated on a chair without back support. The movement types were: 1) ROTATION - shoulder internal rotation with their arm abducted 90 degrees laterally and elbow flexed 90 degrees. 2) FLEXION - complete shoulder flexion until 180 degrees along the sagittal plane. 3) ELEVATION - complete arm elevation until 180 degrees along an imaginary plane placed 45 degrees between the sagittal and the frontal plane. 4) ABDUCTION - complete arm abduction until 180 degrees laterally within the frontal plane (Figure 1a).

Upper arm active movements were detected with an optical motion capture system (BTS SMART DX, Italy) consisting of six infrared cameras. Retro-reflective markers were placed on the trunk and on each of the two arms. The trunk was defined by four markers placed on the skin at the level of incisura jugularis, xiphoid process, seventh cervical vertebra and eighth thoracic vertebra. The arm was defined by a cluster of five markers on a plastic support fixed to the arm with Velcro straps. Intersection points of HA were identified by a set of equal spaced planes and the minimum average distance (MD) of the points from their barycentre was computed. In addition, the mean angle (MA) of the HA was computed (Figure 1b,c).3,4

Results

A significant difference was observed between MD in the two groups during Rotation, Flexion and Elevation (p<0.001), with larger values for the elderly group (Figure 2a).

MA was significantly higher for elderly subjects during Rotation (p<0.001), while it was lower during Abduction (p<0.01). (Figure 2b)

Conclusion

The extraction of Helical Axes parameters showed to be a promising technique to analyse shoulder stability, allowing to observe differences between young and elderly subjects during controlled repetitive tasks.

REFERENCEs:


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